

AN AUSTRONESIAN PRESENCE IN SOUTHERN JAPAN: EARLY OCCUPATION IN THE YAEYAMA ISLANDS.

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ABSTRACT

Archaeological research in the Yaeyama Islands, southern Japan, has a hundred year old history, yet little of it is known to those archaeologists working outside the immediate area. This area is of importance to those working in Southeast Asia and the Pacific as the colonisation of the Yaeyama Islands allows a closer assessment of the nature and timing of Austronesian movement out of Taiwan. This paper will examine the colonisation of the Yaeyama Islands and its archaeological signature, Shimotabaru pottery, by first reviewing the archaeological developments of this island group, followed by an examination of the timing of colonisation and the nature of Shimotabaru pottery production. It will be argued that the early occupation in the Yaeyama Islands characterised by Shimotabaru pottery is the signature of Austronesian colonisation from Taiwan, from between 4500 and 3900 years ago. Yet the colonising signature in the Yaeyama Islands is of a different character to the Austronesian presence in the islands south of Taiwan. This suggests that the nature of Austronesian expansion in general was more complex than is proposed in the prevailing model.

INTRODUCTION

The extensive mid- to late Holocene migrations which took elements of Neolithic culture into island Southeast Asia and across both the Pacific and Indian Oceans are described collectively as “Austronesian” after the language family closely associated with the dispersal (Bellwood 1997, 2007). Austronesian origins have been sought in east Asia, with much attention focused upon Taiwan. Subsequent expansion is seen as moving through the Batanes Islands southward to the Philippines and Indonesia by 4000 years ago and then to West Polynesia by 3000 years ago, to Madagascar about 2000 years ago and across East Polynesia by 800 years ago. The movements in general are seen by Bellwood (2005, 2007) and Diamond and Bellwood (2003) as having been driven by an expanding Neolithic population and economy. Alternative views propose a more complex set of Southeast Asian origins (Anderson 2003; Szabo and O'Connor 2004; Anderson 2005) and suggest that maritime technology,

possibly in conjunction with change in maritime climates, played more important roles (Anderson 2005; Anderson et al. 2006).

Until now, discussions about the first phase of Austronesian expansion have focused on archaeological sites lying along the route from Taiwan to the Philippines, notably in the Batanes Islands. Yet, this was not the only possible route of initial dispersal. A group of islands located just east of Taiwan, the Yaeyama Islands (Fig. 1), lies in a similarly strategic location. Consideration of early Yaeyamas prehistory can throw some light on the specificity of Austronesian movement out of Taiwan and upon the nature of the migrations.

Despite archaeological attention by Japanese archaeologists during the twentieth century, the Yaeyama island group is still relatively unknown to the archaeological community. There are a number of reasons for this. The first is that archaeological reports from all excavations on Shimotabaru sites have been published in Japanese. Very little has been published in English. A single page summary was published in 1996 (Pearson 2001), and the original description of Shimotabaru in the late 1960s (Pearson 1969:85-86), with a two page discussion on chronology in the early 1980s (Pearson 1981:141). No detailed archaeological description of these early sites has been published in English. Secondly, Japanese archaeologists focus on the Palaeolithic, Jomon, Yayoi and subsequent periods of mainland archaeology. Jomon pottery is found in the Ryukyu Island chain but it ceases at Okinawa and is not found any further south (see Fig. 1). Consequently, the Yaeyamas stand largely outside the general sequence and seldom rate a mention in reviews of Japanese archaeology.

To address this imbalance, and to provide a background to the colonisation of the Yaeyama Islands and Shimotabaru pottery, this paper will present a substantive cultural-historical framework of this region that has been previously unavailable to English speaking academics. This will be undertaken by a re-examination of the colonising phase, including a re-assessment of its timing, the nature of pottery production and exchange, and how this fits into a wider regional picture.

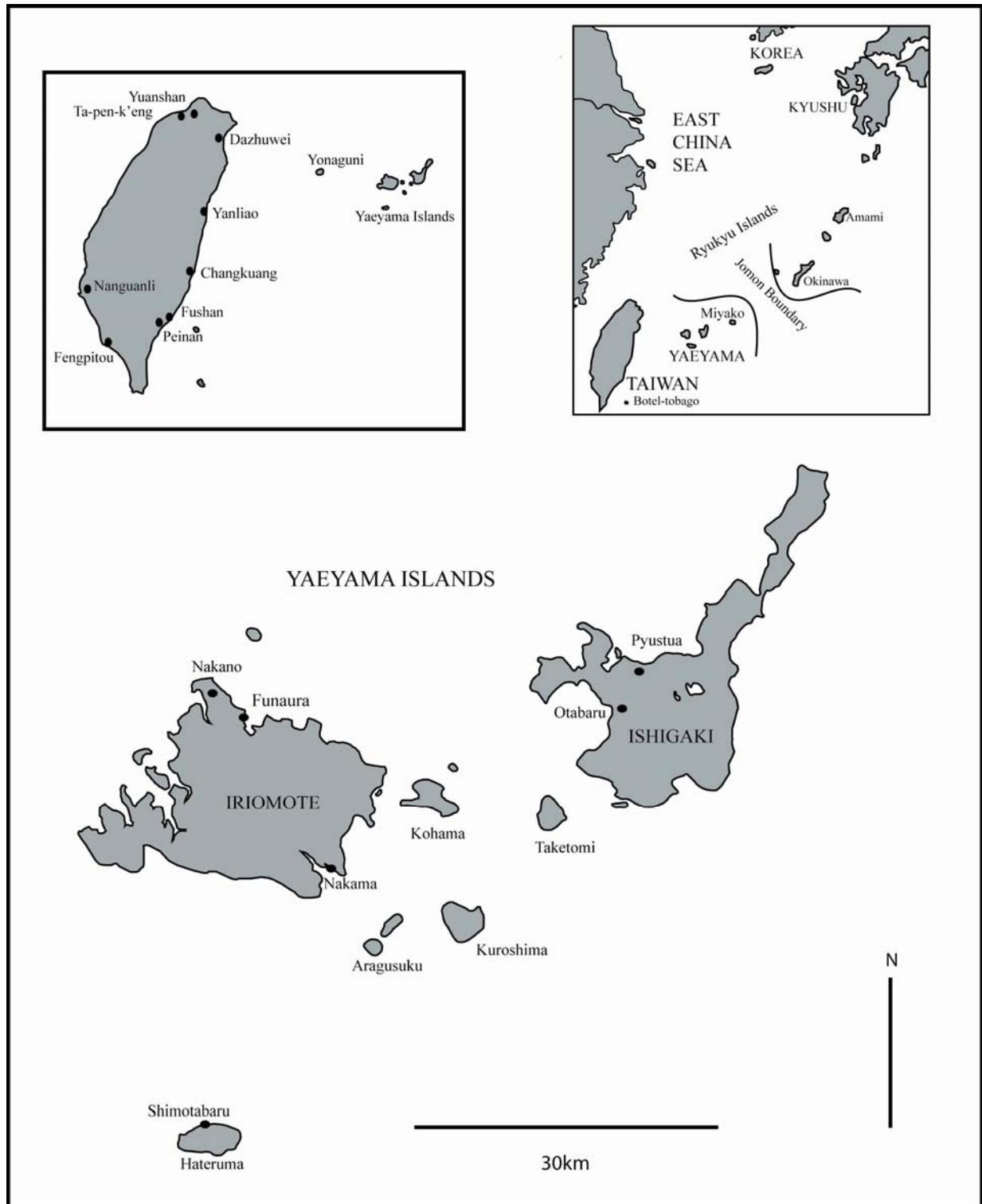


Figure 1. East Asia and Yaeyama Islands: archaeological sites listed in text.

THE SHIMOTABARU PHASE

The Yaeyama Islands are made up of the two larger islands of Ishigaki and Iriomote, and a number of smaller surrounding islands (Taketomi, Kuroshima, Aragusuku, Kohama and Hatoma), and the island of Hateruma 25

kilometres south of Iriomote, and 40 kilometres south west of Ishigaki.

Although forming the southernmost islands of Japan, the Yaeyamas are located in a strategic position as part of an interspersed archipelago that linked China with Japan in past trade networks. They are only 250 kilometres east

of Taiwan. In between is the island of Yonaguni lying 125 kilometres to the west of Yaeyama. To the north is Miyako Island about 90 kilometres away, and at over 400 kilometres lies the main island of Okinawa. The islands of Yaeyama and Miyako are known collectively as the Sakishima Region, and the closer past relationships with this region to areas further south such as the Philippines, rather than any to the north, has been recognised in the literature (Asato 2001:107).

The first archaeological excavation took place at the Kabira shell mound, Ishigaki, in 1904 by Dr Torii Ryuzo of Tokyo University. Half a century later in 1954, the Shimotabaru site on Hateruma Island was excavated by Dr Kanaseki and Dr Kokubu (Kanaseki et al. 1964). This site was re-excavated in 1959 by a team from Waseda University (along with the site of Nakama Shell mound on Iriomote Island) (Nishimura 1960), and in the 1980s a third excavation was undertaken by a team from the Okinawa archaeological survey (Okinawa Prefectural Board 1986). The pottery from this site was a type of crude low fired ware from flat bottomed vessels. It was subsequently found at a number of sites from the Yaeyama Islands and was called Shimotabaru Ware (see below).

DISTRIBUTION OF SETTLEMENTS

Ishigaki

Most Shimotabaru sites from Ishigaki are on small hills or terraces behind the coastline. These sites are found on a red volcanic soil. Their presence behind present day coastal plains was no doubt due to the mid-Holocene marine transgression when the sea level was higher than at present. Chen and Liu (1996: Table 2) estimate a height of 2.4 metres above present levels at 4500-4800 BP and 2.1 metres from c. 4500-3500 BP (Chen and Liu 1996: Table 2). The present day dunes below the Shimotabaru sites would have been covered by water at 4000 years ago. As noted earlier, Shijun Asato (1990:29) partly characterised this "Early Neolithic" by their settlements locations "on low hills near the coast". Ohama was more specific – the occupation is located on "the diluvial plateaux behind the dunes and alluvial plains" (Ohama 1996).

The site of Otobaru is one of these. It is located just over a kilometre inland from the coast on top of a narrow ridge above a river within the Nagura catchment area. Some 4000 years ago the site would have been on an island within an embayment or extended wetland area. Excavations found pottery and stone tools. Not all sites, however, were found on terraces. Pyutsuta is located next to a river, a couple of hundred metres in from the beach, and about 4 metres above sea level. The development of the present beach was later. The excavations recovered pottery, stone, a little shell and not much else.

Iriomote

Like sites on Ishigaki, the site of Nakama No.2 is found on red soil on a low limestone ridge next to a major river. Of note was the surface find of one *Tridacna* adze made

from the hinge, but found with Shimotabaru pottery. It is the only shell adze associated with this early period (Asato 1990:31). Shijun Asato argues for strong connections with the Philippines and southern Ryukyus based on shell adzes (Asato 1990:34). Pearson also recognises shared traits such as *Tridacna* shell adzes, or perforated shell pendants, with the Philippines and Micronesia (Pearson 2001:97).

Hateruma

Unlike sites listed above, the Shimotabaru type site on Hateruma is located on an uplifted beach terrace behind the present beach on the northern side of the island. A 30 metre high uplifted limestone ridge located c.200 metres inland protects the site from the southern side. A fresh water spring is located at its base. The site is slightly raised above areas to the east and west, and was probably an elevated sand spit when it was occupied 4000 years ago and the seas were 2.1 metres higher than today (Chen and Liu 1996).

Surface finds are also known from a dozen other localities from Ishigaki Island. From Iriomote Island, Nakama No. 2 is now accepted as a Shimotabaru site. Also, from the island of Yonaguni, the site of Togurushima is the same age as Shimotabaru sites from Yaeyama, however no pottery has been associated with these remains. Yonaguni is situated between the Yaeyama Islands and Taiwan (Asato 1990, 1991; Okinawa Prefectural Education Board 1985).

Post-Shimotabaru site locations

After the short lived Shimotabaru phase, the next occupation is argued to have been some 800 years later (Ohama 1996:27). It is represented by aceramic shell mounds located on low lying sand dunes. As noted above, these sand dunes did not exist during the earlier Shimotabaru phase as this area was covered by water. Shell adzes appear during this period and are used from 2500 BP to about 1000 years ago (Asato 1990:29-30). Ohama calls this period the Aceramic Culture. The hinge working has led some to see a Philippine origin. An increase in burnt pebbles led Shijun Asato to argue that steaming with stones (earth oven) took over as the major cooking method.

Shimotabaru pottery and adzes

The Okinawan archaeologist Shijun Asato (1990) placed what he called Shimotabaru culture into the earliest phase of occupation in this island group. Asato characterised this "Early Neolithic" not only on the basis of pottery but also by site occupation, partly polished adzes, and scarce faunal remains. Local amateur archaeologist, Eisen Ohama (1996:27), called this pottery the "Red Pottery Culture" and describes it as a red earthen ware with "a bucket shape with a pair of bull horn shaped handles on both side of the bodies as well as bone needles and points" (Ohama 1996). Basically the pottery is crudely constructed, low fired earthen ware. It has a standardised form - a flat base open unrestricted vessel, with direct

rims. Some of the vessels are slightly incurving. Lugs/handles, in the form of large applied knobs of clay, are located just below the lip of the vessel. Ohama's description (above) is an apt one.

There is little evidence of decoration on Shimotabaru pottery. One sherd from the Shimotabaru site has parallel striations (Okinawa Prefectural Board 1986: Plate 8, no. 6). From Pyutsuta there is evidence on a handful of sherds of wide incision running from the rim to the base of the vessel wall, while one sherd has two lines of single tool impressions running just below the rim. Half a dozen sherds have evidence of fingernail impressions placed in vertical lines from the rim to the base (Ishigaki City Education Board 1997: Pl. 11-13, 21 and 33).

As noted above, adzes are found with Shimotabaru pottery. These stone adzes are semi-polished and chipped into a variety of cross sections and shapes. All are made from local rocks which occur naturally in Iriomote and Ishigaki. From the early excavations on Hateruma, Pearson (1969) (from Kanaseki et al. 1964) noted that the adzes were divided into two on the basis of cross sections: trapezoidal and rough ellipsoidal. It was also noted that just under half the adzes (those with rough ellipsoidal section) had a "rough transverse step on one side", which may have been an attempt at "stepped butt" construction (Pearson 1969:85). However, the excavations from Otabaru (Okinawa Prefectural Education Board 1980:63-91), Pyutsuta (Ishigaki City Education Board 1997: pl. 34-35) and the later excavations at the Shimotabaru type site (Okinawa Prefectural Education Board 1986: pl. 18-25) have yielded many varieties of chipped and polished adzes, including lenticular, quadrangular/rectangular, and trapezoidal cross sectioned adzes.

Prehistoric economy

According to Shijun Asato (1990:29) the Shimotabaru inhabitants subsisted on fish and shells gathered from lagoons. The material culture included "pendants or weapons made of shark teeth with an opened hole and shells of *Chiragra* spider conch" (Asato 1990:29). The presence also of edge ground adzes and pottery raises the question of whether there was also agriculture. Unfortunately, the evidence for diet is limited, because of low organic survival in the volcanic soils of many of Shimotabaru sites. Otabaru and Pyutsuta have little bone or shell surviving.

However, the Shimotabaru type site on Hateruma, a raised limestone island, has beach midden deposits. Organics include shell beads, fish bone, some fresh water shellfish from Iriomote, and mangrove species of shells. The latter were probably imported as there are no mangroves found on Hateruma. There is also plenty of pig bone in the deposit. There is no chicken. The pig is *Sus leucomystax riukiuanua*, which Colin Groves renames *Sus scrofa riukiuanus* (Groves 1981: 35-36). *Sus leucomystax* is the Japanese wild boar. Whether pig was brought to the Yaeyamas during the Shimotabaru phase is unknown. Pig bone is supposedly found on Ishigaki, in non-archaeological contexts and dated to 8500±500 BP,

although it was pointed out that, "determinations on bone of this type are not always reliable" (Foster 1965: 83, Pearson 1969:82).

Another site, Nakama No. 1, which was excavated in 1959, also yields evidence of a prehistoric economy. Dugong, boar, and turtle bone was found in the early deposit. This, along with chipped and polished adzes (polished rectangular in plan, and oval in cross section) which are said to resemble those in east Taiwan, plus pecked hammer stones, suggests an external link (Pearson 1969:84).

Unfortunately, there has been no study on early agriculture in the Yaeyamas. No environmental work (pollen, phytoliths etc) has been undertaken to assess changes in vegetation with the advent of people. It has been argued that the earliest evidence for rice further to the north in Okinawa was during the Heian period by AD 200 (Pearson 2001:96). It was argued that those people lived a hunting and gather existence with a very late introduction of agriculture (and here agriculture equates with rice) during the Gusuku Period at between c.AD 1100 and 1400 (Takamiya 2006:60). Such a scenario for the Yaeyama Islands seems unlikely, as will be argued below.

CHRONOLOGY OF THE SHIMOTABARU PHASE AND ITS RE-ASSESSMENT

Although early radiocarbon dates on Shimotabaru sites suggesting occupation in the early fourth millennium BP were obtained over thirty years ago, they were ignored as pottery was considered to have been a late addition to the archaeological record. The earliest occupation on these islands was thought to have been aceramic with Shimotabaru pottery appearing in a later phase (Pearson 1969). Pearson's chronology followed the development of a four cultural period chronology by Mr Tawada in 1956, and also by the Waseda University team in 1959. The latter saw the earliest occupation in the Yaeyamas associated with lithics found at the Nakama No. 1 site on Iriomote Island. They interpreted pottery in association with lithics found in nearby sites (Nakama No. 2) as later in time. We now know that in fact the sequence should be reversed. With added radiocarbon dates available in the late 1960s from Hateruma (Kokubu 1966a and b, 1973; Yamasaki et al. 1967), Pearson (et al. 1978: Table 1) noted that perhaps the islands were inhabited in the second millennium BC. Yet, at that time there was an absence of excavated Shimotabaru sites on both Ishigaki and Iriomote, and these islands were still considered to have been occupied much later. The only sites available for comparison at that time were from Iriomote: Funaura and Nakama 1 (Pearson et al. 1978:13). Pearson did not consider Nakama 2 to have been early.

Thus up until recently, the published (in English) orthodox chronology for this region had the occupation of these islands with a pre-ceramic phase at 2000 B.P. Yet, over the last few years local archaeologists have rewritten the cultural sequences using data from archaeological excavations which identify an early occupation phase with Shimotabaru pottery dating from the early

Table 1. Radiocarbon estimates for Shimotabaru pottery (e = estimated)

Lab. no.	Sample	Reference	Original C-14 age	$\delta^{13}\text{C}$	Date after $\delta^{13}\text{C}$ correction	Calibrated age 2σ (95.4%) cal BP
SHIMOTABARU						
Gak-3766	Shell	Pearson et al. 1978; Ohama 2000	3780 $\pm$ 100	+1.1 (e)	4203 $\pm$ 100	4550-3990
Gak-3765	Shell	Pearson et al. 1978; Ohama 2000	3290 $\pm$ 90	+1.1 (e)	3713 $\pm$ 90	3870-3410
N-259	<i>Geloina papua</i>	Yamasaki et al. 1967	3800 $\pm$ 130	+1.1 (e)	4223 $\pm$ 130	4700-3950
not given	Charcoal	Okinawa Prefectural Board 1986	3740 $\pm$ 85	-25.0 (e)	3740 $\pm$ 90	4410-3880
not given	Shell	Okinawa Prefectural Board 1986	3660 $\pm$ 70	+1.1 (e)	4083 $\pm$ 70	4350-3920
PYUTSUTA						
Beta-97153	Charcoal	Ishigaki Town 1997	4230 $\pm$ 50	-26.5	4230 $\pm$ 50	4870-4580
Beta-97154	Charcoal	Ishigaki Town 1997	3920 $\pm$ 50	-22.5	3920 $\pm$ 50	4520-4160
OTABARU						
Unknown	<i>Tridacna</i>	Okinawa Pref. Ed. Board 1980	3970 $\pm$ 95	+1.1 (e)	4393 $\pm$ 95	4810-4310
Unknown	<i>Tridacna</i>	Okinawa Pref. Ed. Board 1980	3870 $\pm$ 65	+1.1 (e)	4293 $\pm$ 65	4610-4220
WK-15793	<i>Mallotus japonicus</i>	Summerhayes and Anderson	n/a	-25.13	3841 $\pm$ 35	4410-4150

fourth millennium BP. The revised chronology was first published by Takemoto and Asato (1993) and Kin (1994), while Pearson was the first to mention the new chronology in English, albeit briefly, in 1996 (Pearson 2001 – originally published in 1996). This new sequence is based not only on the re-excavations of Hateruma in the mid 1980s, but also by excavations at the following sites: Pyutsuta on Ishigaki Island excavated in the mid 1990s (Ishigaki City Education Board 1997); Otabaru on Ishigaki Island excavated first in the early 1980s (Ishigaki City Education Board 1982) and subsequently in 2004; and the Soedo site from Tarama Island located between the Yaeyama group and Miyako to the north (35 kilometres from the northern tip of Ishigaki) (Okinawa Prefectural Tarama-village Education Board 1996).

On the basis of variety in decoration it was argued by some that Shimotabaru pottery had temporal depth. Ms Shimabukuro, who excavated the Pyutsuta site, argued that thick wide incised lines as a decorative trait were an older form of decoration than others, such as nail impressions (Ishigaki City Education Board 1997). Kishimoto (2004) also argues for chronological differences in Shimotabaru pottery. His study looks at elements of decoration and attempts to put them into chronological sequence. He argued that Pyutsuta Layer 5 was the oldest, followed by Otabaru and Nakama No 2, then followed by Pyutsuta layer 3, with the youngest being the Shimotabaru type site on Hateruma.

In summary, the original radiocarbon estimates (Table 1) show colonisation of these islands by a group or groups of people over a very short period in the early fourth millennium BP. Kin (1994), and Ohama dated this Shimotabaru or red slipped pottery age to between 4000 and

3500 BP. These radiocarbon determinations, however, were never calibrated to solar years.

A seed sample collected from the 2003 excavations of Otabaru by the Ishigaki City Board of Education, given to Anderson and Summerhayes for radiocarbon dating, was identified by Dr Andrew Fairbairn (then of the Australian National University) as *Mallotus japonicus* in the family Euphorbiaceae. According to Fairbairn (pers. comm.) it is a deciduous shrub/tree common in open woodlands and thickets. The sample was sent to the Waikato Radiocarbon Laboratory for AMS dating. It produced a radiocarbon estimate of 3,841 $\pm$ 35 BP (Wk-1579), which when calibrated gave a calendrical age range 4410-4150 cal BP (95.4% or 2 standard deviation cal age range). Calibration was based on Reimer et al. (2004) using the CALIB 5.1.0.0 program, Intcal 04.14c – see below for more detail.

When reviewing the published radiocarbon age estimates for Shimotabaru sites it became evident that estimates made on marine samples were much younger than those made on charcoal, even if they were paired samples from the same stratigraphic layer. This is a result of no $\delta^{13}\text{C}$ corrections having been performed on the original marine radiocarbon determinations. Consequently, all published dates have been $\delta^{13}\text{C}$ corrected here and then calibrated using Calib 5.1.0.0 (see Stuiver et al. 2005). Where a $\delta^{13}\text{C}$ correction was not originally made, an estimate of +1.0 and -25.0 was used for marine and charcoal samples respectively (Stuiver et al. 2005: Chapter 5, Table 1). Two datasets were used for the calibrations: The IntCal 04.14C NH terrestrial calibration dataset was used on charcoal/seed samples (see Reimer et al. 2004), while the Marine 04.14C "global" marine

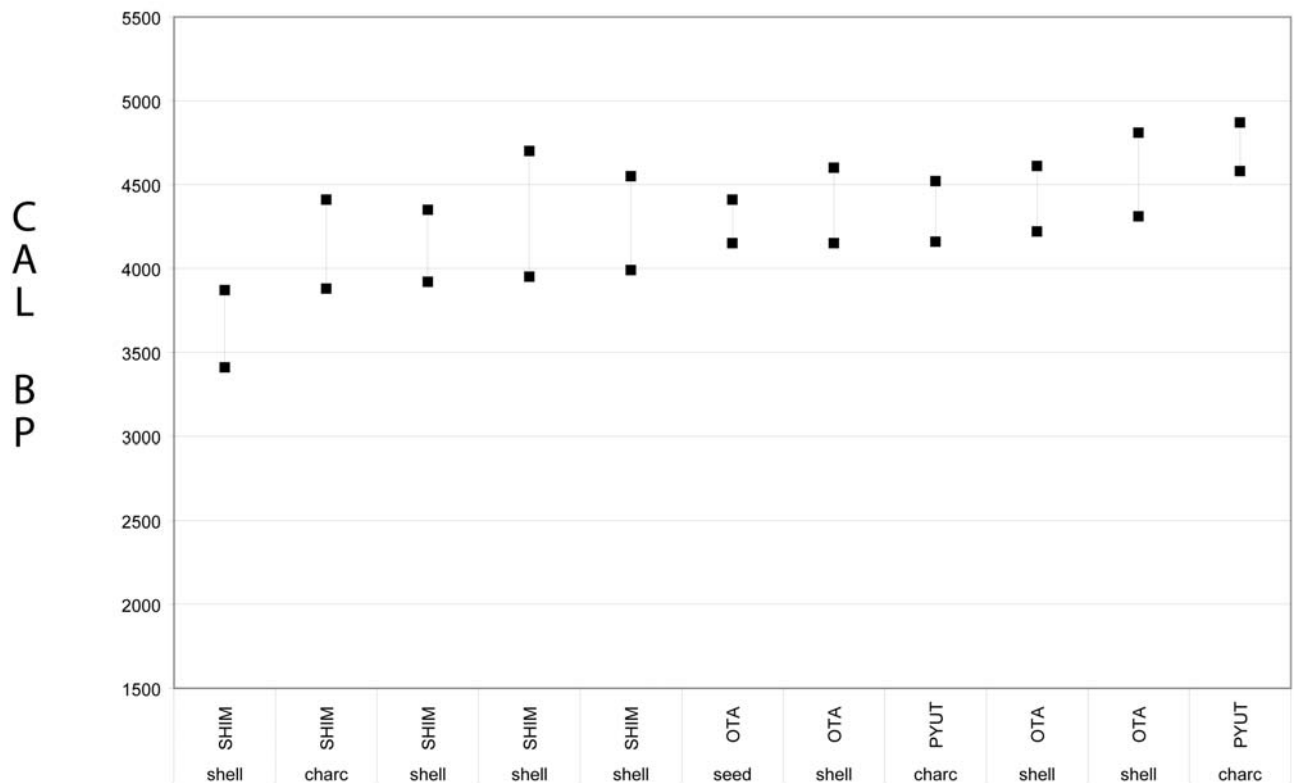


Figure 2. Age estimates for Shimotabaru pottery

calibration dataset was used on marine samples (see Hughen et al. 2004). For marine samples, a delta-R value of 0 is applied in the absence of a local offset value. Table 1 presents the results showing the original raw radiocarbon determination, the determination after $\delta^{13}\text{C}$ corrections, and the calibrated age ranges.

As can be seen from Table 1 and Figure 2, Shimotabaru pottery dates from the middle of the 5th millennium BP to the early 4th millennium BP. The age for this occupation falls in the range 4500–3900 cal BP.

The dates above suggest that Kishimoto's (2004) chronological separation of Shimotabaru sites based on decoration may be partially right. He predicted that the Shimotabaru type site is younger than Otobaru and Pyutsuta. The problem, however, is layer 3 is older than layer 5, while stylistically Pyutsuta Layer 5 is argued to be older. The older date from Pyutsuta does not sit well with the other Shimotabaru dates, and if ignored would suggest that the initial occupation of these islands was in the mid to late 5th millennium cal BP.

INTERACTION AND POTTERY PRODUCTION

There is much to tell us about interactions amongst the Yaeyama Islands. Pig, fresh water shell fish/mangrove shell species and stone adzes must have been imported to Hateruma from Iriomote and Ishigaki. Interaction between the islands is also suggested by the homogeneous nature of the pottery. An examination of the production of pottery can provide us with a handle on the nature of these interactions. Prior to our study little was known

about the production of Shimotabaru pottery. Clays suitable to make pottery were located on Ishigaki. Next to the site of Otobaru were found the Nagura Gravels, a geological formation made up of clays and sands (Foster 1965). Iriomote has little clay, while no clays are found on Hateruma.

A major aim of our research was to undertake a chemical characterisation analysis on the pottery to help determine production patterns of these early colonising populations. We needed to know whether similarities in style of this low fired red pottery was due either to production in one area and then exchange, or independent production in different areas, but according to a common tradition.

This information is important in determining the nature of colonisation and interaction between colonising populations. Studies undertaken by Summerhayes (2000) demonstrated that the production of pottery by colonising populations from the western Pacific was complex, with stylistically complex identical wares being produced using different technologies and resources from a number of locations. This production pattern was an epiphenomenon of the process of colonisation and the high mobility of these populations. An understanding of the production strategies would thus shed light on the nature of settlement of these early colonisers of Yaeyama.

Detecting production patterns of Shimotabaru pottery

We employed electron microscopy to provide characterisation data allowing the modelling of production patterns.

For this study a sample of 22 sherds were provided from the Shimotabaru assemblages of Hateruma (n=3), Otabaru (n=5) and Pyutsuta (n=14). The Hateruma samples came from excavations undertaken by Shijun Asato of the Okinawa Prefectural Board (1986); Otabaru from excavations in 2003 by Mr Suguru Shimoji (unpublished); and excavations at Pyutsuta in the 1990s by Suguru Shimoji and Ayano Shimabukuro of the Ishigaki City Board of Education (1996). They were selected by the excavators (Asato and Shimoji) as representing the fabrics within the assemblages.

The electron microscope provides separate chemical analyses of the clay matrix and minerals, rather than the blend of both which most other techniques provide (see Summerhayes 2008). The reason for this is that the samples are not crushed and a smoothly prepared sample can be moved under the electron beam for spot analysis. The chemical results allow the characterisation of production by grouping sherds on the basis of their chemical similarity into groups called “Chemical Paste Compositional Reference Units” (CPCRU) (Bishop, Rands, and Holley 1982, see also Summerhayes 2000: chapter 4 for a detailed description).

Every sherd was examined using a low powered (x15) binocular light microscope to determine macro fabrics. All chemical analyses were undertaken using the JEOL JXA-8600 electron microprobe fitted with an EDS (Energy Dispersive Spectrometer) EUMEX Si detector, housed in the Department of Geology, University of Otago. Machine conditions used a negative potential of 15 KeV accelerating voltage. Analyses were undertaken at X20000. Sherd samples were impregnated in epoxy resin pellets. Preparation of sample pellets is identical to those outlined in Summerhayes (2000), with the exception that slides were not made. Elements analysed were Mg, Al, Si, K, Ca, Ti, and Fe. Multivariate statistical analysis was undertaken on the elemental data from the ceramic matrix using the statistical package MVARCH (Wright 1991). Principal components analysis was used with the data standardised using log transformations, and the components used for hierarchical clustering analysis to identify clusters in the chemical analysis and define CPCRUs. A primary aim in the quantitative elemental characterisation of pottery was to define groupings. The groupings were expected to make not only make chemical sense, but also archaeological sense.

RESULTS

Ceramic matrix

The chemical analysis of the ceramic matrix demonstrates that the production of Shimotabaru pottery from Pyutsuta, Otabaru and Hateruma were not from the same clay sources. Sherds from these sites have different chemical compositions. Four CPCRUs were formed using Principal components analysis (see Figs 3 and 4, and Table 3). The first three are chemically homogenous units, while the fourth is not, being made up of only two samples both dissimilar from the other CPCRUs. They are grouped together for convenience only.

1. Pyutsuta
2. Hateruma
3. Otabaru
4. Two outlier Otabaru samples.

Pyutsuta separates from both Otabaru and Hateruma on the first component where the element Calcium (Ca) loads heavily. Hateruma forms a tight group of three samples, while Otabaru groups into two CPCRUs (n=2; n=3), primarily on the basis of Ca. The Otabaru CPCRU 4 samples have less Ca than the other samples, with on average 0.1%. This is followed by the Pyutsuta samples with on average 0.5 %, while Otabaru CPCRU 3 and Hateruma CPCRU 2 samples have 1.5% and over 2% Ca respectively. This suggests that Pyutsuta CPCRU 1 and Otabaru CPCRU 4 with lesser amounts of Ca could well be formed from volcanic clays, while Hateruma CPCRU 2 and Otabaru CPCRU 3 developed out of calcareous clays.

Table 2. Elemental PCA Eigenvalue loadings for 3 principal components.

	1 st p.c.	2 nd p.c.	3 rd p.c.
MG	0.0403632	0.1556307	0.0891848
AL	-0.2724789	-0.0407119	0.0097689
SI	-0.1291052	-0.1653275	0.1483268
K	-0.1631932	-0.2160668	0.2523324
CA	0.7361859	-0.2281862	-0.0973065
TI	0.1752799	0.4166451	0.0326447
FE	-0.0625179	0.1862899	-0.0473686

Hateruma CPCRU 2 separates from Otabaru CPCRU 3 primarily on the third component (Fig. 4), where potassium (K) loads heavily. Hateruma has lesser K than Otabaru.

Thus we have identical pottery found from a number of sites, each made with different clays. Two sites, Shimotabaru on Hateruma and Pyutsuta on Ishigaki, would have had their pots or clays carried in. As noted earlier the island of Hateruma has no clays, and suitable clays are not located near Pyutsuta which is situated on sandy deposits and next to a granite spur protruding perpendicular to the beach (Foster 1965).

Identifying the origin of clays used in pottery manufacture is always difficult to assess. However, the catchment behind Nagura Bay encompassing the site of Otabaru contains a variety of clays which could have provided the variety of CPCRUs seen in this study. For example, non-calcareous clays are found in the Nagura Gravels located in the Nagura catchment. These clays have a yellowish brown colour with reddish streaks (Foster 1965:50). Those CPCRUs with higher concentrations of Ca may have originated from coastal marine terrace deposits. Yet it is also noted that clays described as calcareous are also found near the Nagura catchment (Foster 1965:56). Thus the potters from Otabaru had access to both clays. There was an area on the east coast of Ishigaki (1.5 kilometres north of Miyara) where clay

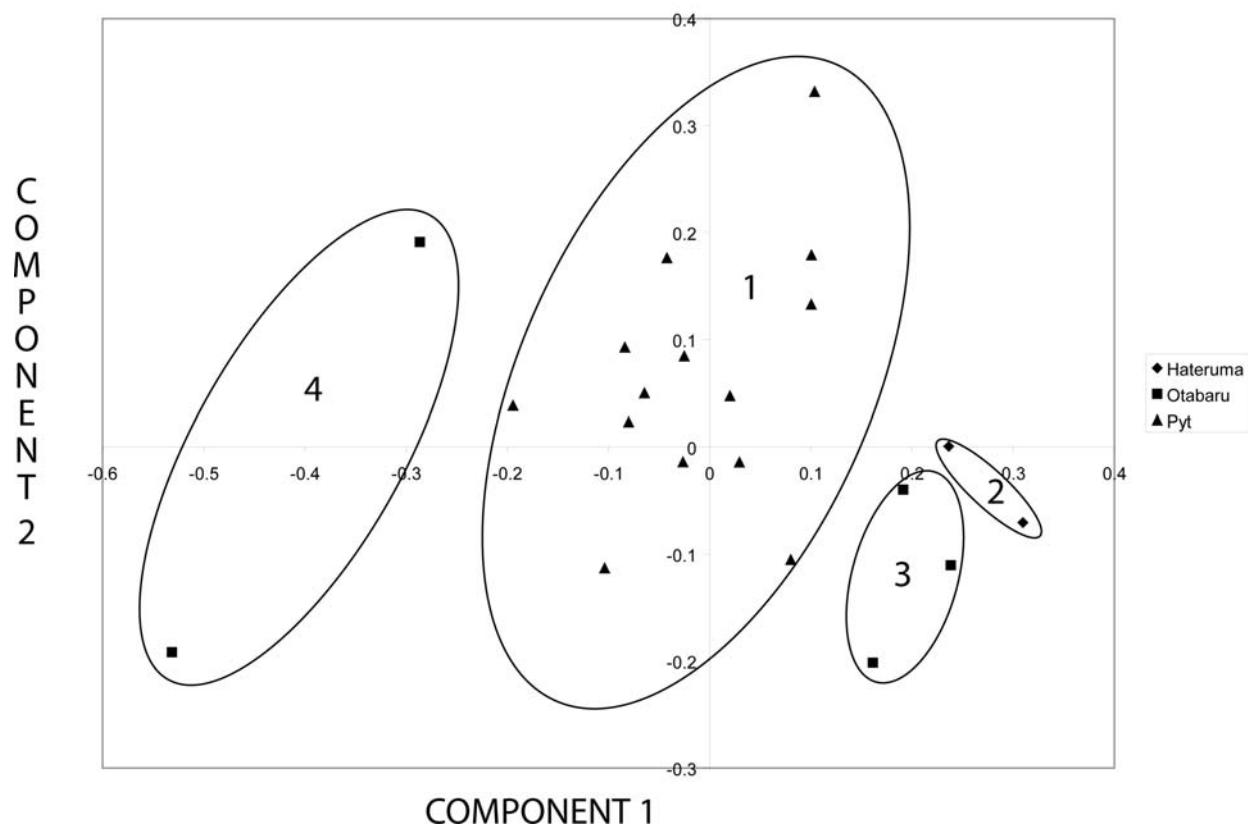


Figure 3. Shimotabaru pottery CPRUs – PCA plot on the 1st and 2nd component

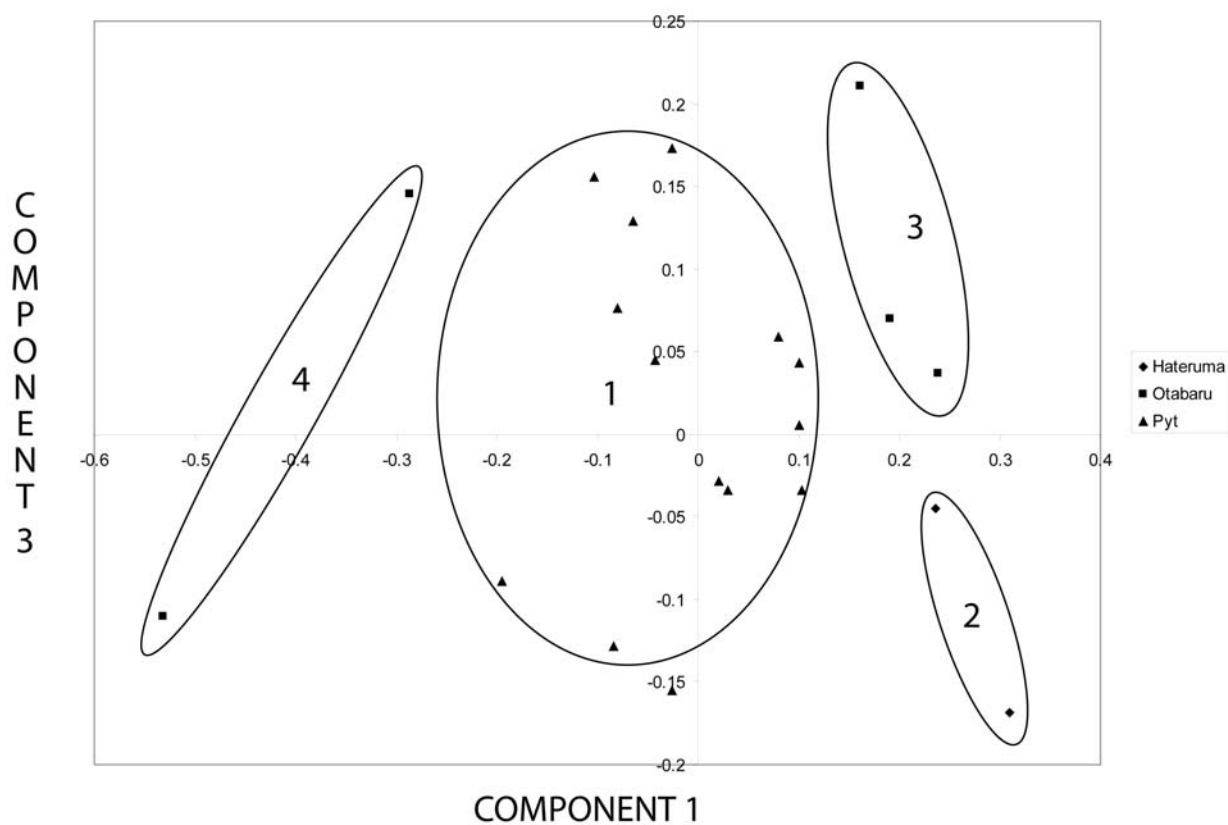


Figure 4. Shimotabaru pottery CPRUs – PCA plot on the 1st and 3rd component

for pottery was dug in recent times, however, it can be discounted for use with the pottery under analysis as it was based on weathered andesite (Foster 1965:107). Minerals associated with andesite have not been found in this pottery (see below).

Inclusions

There are four fabrics identified by the analyses (see Table 3). The first (fabric 1) is made up of alkali feldspars, epidote and quartz. This fabric is identified in Otabaru's CPCRU 3 (1 sample) and 4 (2 samples). Alkali feldspar is found in one of the Pyutsuta sherds but not with epidote. This sole sherd makes up fabric 2.

Table 3. Presence of fabrics in CPCRUs.

Fabric	CPCRU 1 Pyutsuta	CPCRU 2 Hateruma	CPCRU 3 Otabaru	CPCRU 4 Otabaru
1	-	-	X	X
2	X	-	-	-
3	X	X	X	X
4	X			

The third fabric is similar to fabric 1, except it is lacking alkali feldspar, being made up of quartz, epidote and ferrous oxides. This fabric is common to all CPCRUs with five samples identified from Pyutsuta's CPCRU 1, and one sample each from Otabaru's CPCRU 3 and 4. Fabric 3 is the sole fabric identified from Hateruma (CPCRU 2). The last fabric (Fabric 4) is made up of just quartz and ferrous oxides without the epidote, and is identified in the remaining Pyutsuta's samples (n=4).

Of interest is the presence of quartz in all fabrics and the presence of epidote in two of these four fabrics. Epidote is a mineral formed from metamorphosed rocks and is common in the geology of Ishigaki Island. Epidote, plus quartz and some feldspar is associated with greenschist. Pumpellyite glaucophane is also associated with quartz and ferrous oxides and no epidote. These combinations can account for the four fabrics identified and are all found in the catchment area behind Nagura Bay where Otabaru is located. Other metamorphic rocks with epidote and quartz are located on Ishigaki, yet these can be discounted as they are found in association with mica. Mica is noticeably absent in this pottery. Also noticeably absent are the inclusions from igneous derived deposits such as andesite or rhyolite (pyroxenes or plagioclase of any kind).

DISCUSSION

We can now return to the question of whether similarities in pottery style were due to exchange and distribution of pottery from a single area, or to production in a number of areas. The results suggest production in a number of areas. More than one clay source was used with different mineral tempers to produce a stylistically similar ware. This ware, or the clay and temper, was imported to Hateruma Island and also Pyutsuta. From the distribution of clays and minerals presented above, they could all have

come from the Nagura Basin catchment, on the south west coast of Ishigaki.

Not much exists to make chemical comparisons with these results. From Taiwan comparable pottery from the sites of Tapenkeng and Fengpitou (see the section below) were analysed by X-ray diffraction analysis (Chang 1969: appendix 1). Such an analysis provides an indication of which minerals were present. The pottery from Fengpitou ranging from the TPK phase, through to the sandy red ware phase, to black ware and later materials all had quartz, feldspar and mica present. Tapenkeng pottery also from the full range of phases found within that site, also contained mainly quartz, with feldspar, and mica. These compositions are unlike those from the Yaeyama assemblages.

A possible connection could be made with a lug sherd sent by Richard Pearson to Bill Dickinson for analysis from Funaura site, Iriomote. This site is located on a ridge 1 kilometre west of the Funaura shell mound, and Pearson suggests that the sherd may be related to the early Shimotabaru ware (Pearson 1981:176). Unfortunately as noted by Pearson, the site was destroyed by agricultural activity and bulldozing. Petrographic analysis has the temper as 90% quartz, with feldspar and quartz (Dickinson 1981:171; see Fitzpatrick et al. 2006 for an update on this analysis). An origin with the "erosion of sedimentary strata including sandstone beds" was suggested.

In summary:

1. Shimotabaru pottery was not made from a single specialist production centre and then distributed across the archipelago (see Fig. 5).
2. All clays and minerals used in the production of Shimotabaru ware could have originated from a restricted geographical location near the site of Otabaru.
3. No pots were exchanged between these three sites. Each site used separate clays – i.e. all CPCRUs are site specific.
4. The production distribution suggests three points: the importing of pots or resources into Hateruma from Ishigaki; the importation of pottery or resources into Pyutsuta from other areas within Ishigaki, probably from the Nagura catchment area; and local production at Otabaru.

Thus, a colonising group made identical pottery using many resources, and moved some to outer islands, along with adzes (see below) and probably a transported economy as well.

SHIMOTABARU AND THE REGIONAL PICTURE

The dates for colonisation of the Yaeyama Islands at between 4500-3900 years ago fit well with new research from Taiwan and islands to the south. The archaeological evidence suggests that these early colonisers probably came from Taiwan. Connections to the Jomon Cultures to the north can be discounted on a number of reasons. First, the Shimotabaru pottery is totally unlike anything seen in the Jomon of Okinawa. It has been suggested that it is similar to plain ware found in archaeological sites in east Taiwan. The same can be said for the adze forms, some of

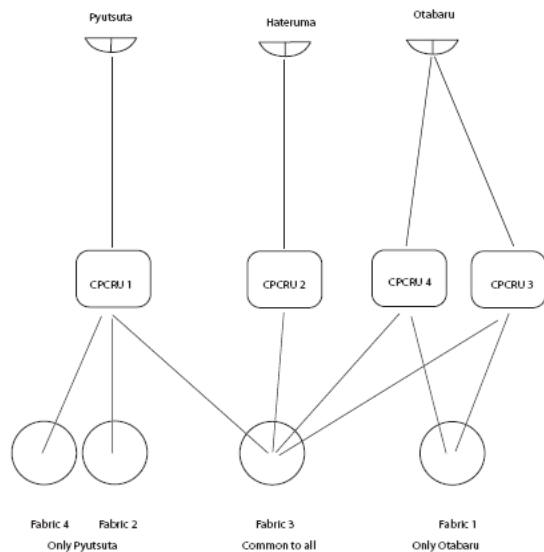


Figure 5. Production of Shimotabaru pottery

which are not found north of Okinawa (Kokubu 1963:229-231). Secondly, the distance of open sea (400 kilometers) between the Yaeyama Islands and Okinawa was probably too great for Jomon hunter-gatherers to cross, judging by the apparent restriction of voyaging distances to less than about 350 km elsewhere in the prehistoric Pacific prior to the late Holocene. Thirdly, there is evidence of occupation on Yonaguni (Toguruma site) at the same time as the Shimotabaru sites which suggests that colonisation passed through that island. Links between the Sakishima Islands and Okinawa are thought to have been very weak or non-existent (Ito 2003:63).

Connections with Island Southeast Asia can probably be ruled out, at least for agriculturalists. Neolithic occupation in the Batanes, Philippines, Indonesia or islands to the south, seems to have occurred slightly later than occupation of the Yaeyama sites, although the chronological data are still in flux. Occupation could have come from mainland China, but that would have involved a direct sea crossing of about 460 kilometres. Furthermore, Yaeyama is latitudinally further south than the capital of Taiwan, Taipei. Thus anyone leaving from the closest mainland Chinese landfall would have had a trip round the northern half of the island of Taiwan. In addition, there are no similar pottery assemblages on mainland China at a comparable age (see Jiao 2007a).

The Taiwan connection – pottery (see Fig. 1 for Taiwan sites)

If the Shimotabaru Ware came from Taiwan, to which assemblages is it related? An early contender was the TPK cultural complex. TPK was found and named after the site of Tapenkeng (or Dabengkeng) located near Taipei and dated to between 5500 and 4500 years ago (Chang 1969). The pottery from the TPK culture (incised and cord marked) has a wide distribution round coastal areas

of Taiwan. In terms of pot shape and decoration it is fairly homogeneous which has led some to argue that the TPK people “belonged to a relatively unified cultural milieu and were perhaps immigrants into Taiwan from Fujian or Guangdong” (Bellwood and Hiscock 2005:283-284). K.C. Chang (1995) also argued that similar pottery is found on mainland China at this time. Evidence for this is also seen in the presence of TPK sites located on the Penghu Archipelago located 45 kilometres west of Taiwan, and 140 kilometres east of mainland China (Tsang 1992:3). Other characteristics of TPK culture included red paint and red slipped pottery, stone bark cloth beaters, shouldered stone adzes, baked clay spindle whorls, shell bracelets and ear rings, dog burials, carbonised rice and foxtail millet remains. Most of the TPK sites were found on ridges or hills overlooking the coastal plain, such as Fengpitou (Chang 1969). It was long thought that the TPK pottery was the immediate precursor of the red slipped pottery traditions that supposedly moved south into the Philippines. That is, people from a later stage of this TPK culture moved into the Philippines.

TPK seems slightly too old to have been associated with Shimotabaru pottery from Yaeyama, although the latter appeared when the former declined. Furthermore, no paddle impressed ware (characteristic of TPK) was found in Shimotabaru deposits. A recent re-assessment of the TPK now views it as too old to be related to the Austronesian movements from Taiwan into the northern Philippines (Bellwood and Hiscock 2005:284). Bellwood, for instance, now thinks that the earliest pottery from the Batanes and northern Philippines which he believes dates to 4000 – 3500 BP (which we now know post-dates the Yaeyama sites) looks most like post-TPK pottery (Middle Neolithic) from Taiwan, such as the Yuanshan culture of the Taipei basin and the Peinan Culture of southeast Taiwan. Both derived from the TPK and have predominantly red slipped pottery, and stamped design, without cord marking (Bellwood and Hiscock 2005:284). (See Bellwood and Dizon (2005, 2008), and Bellwood et al. (2003) for recent results from the Batanes Islands, and Anderson 2005 for contrasting views).

Hung (2008: 52) identifies the Middle Neolithic of Taiwan (4450-3450 cal BP) as a period of growth. She notes that although TPK and the Middle Neolithic were similar in time depth, the number of Middle Neolithic sites increased sevenfold. She has identified five major “regional cultural facies”: Xuntangpu in northern Taiwan, Niumatou in central-west Taiwan, Niuchouzi in southern Taiwan, Fushan in eastern Taiwan, and Hongmaogang in the northwest (Hung 2008:50-52). In eastern Taiwan, she notes that the Beinan (Peinan) phase is later than the Fushan phase (Hung 2008:76).

The dates for Beinan fit well with the earliest dates for red slipped pottery in the northern Philippines at between c.4000-3500 BP (Hung 2005) but they are later than the Yaeyama Shimotabaru assemblages. Hung also notes similarities between pottery from north Luzon sites of Nagsabaran and Irigayen (excavated by Ogawa) and from Taiwan.

For instance:

1. Everted concave rims are shared between these Philippine sites and in eastern fine cord marked pottery sites of Yuchangnan, Fushan, Yanliao, Dakeng and Shanyuan dated to 4000-3500 BP. Also found is polished red slipping.
2. Everted rim with outer thickening of the lip is found at Magapit on Northern Luzon, the Batanes site of Torongan Cave (1600 BC), and several sites (Fushan, Jialulan and Shanyuan) in southeast Taiwan.
3. Bowls on ring feet are found in northern Luzon with red-slipped pottery at Nagsabaran, Dimolit, Magapit and Irigayan. In Taiwan they are found at Fengpitou, and in the eastern Taiwan sites of Fushan, Zhanchang, and Peinan.
4. Basins are found at Nagsabaran in the Philippines, and at Fengpitou (fine corded pottery), and Qiguan in Taiwan. The surfaces of these vessels have red slip or fine cord marks (Hung 2005).

Although strengthening links between Taiwan and the northern Philippines, unfortunately none of these vessel forms were found in the earlier Shimotabaru assemblages. Also, there is no cord marked pottery from the Yaeyama assemblages (and, in fact, almost none from the Philippines). It should be noted, however, that the absence of cord marking is not as important as it seems. Hung (2005) makes the important point that fine cord mark sherds only make up 10% or less of the assemblages in the eastern Taiwan sites such as Fushan. This site was dominated by red slipped or plain pottery, and contains a pot form similar to Shimotabaru pottery (see below).

Shimotabaru pottery has been argued to have originated from the post-TPK assemblages. Ohama (1996:27, 1999: 52-56) proposed over a decade ago that the Red Slipped Culture originated from the following assemblages:

1. Post-TPK assemblages at Fengpitou in south-western Taiwan,
2. Yuanshan Culture north coast of Taiwan
3. Peinan culture on East coast of Taiwan.

Since Ohama's landmark publication, more is now known about the Middle Neolithic assemblages of Taiwan. Similarities with Shimotabaru pot forms are seen in assemblages from the east coast of Taiwan where two handled vessels were common during the Middle Neolithic. Sites where these are found include Fushan (Shi et al. 2001:67) and Dazhuwei (Da-zhu-wei) (Liu et al. 2001) which date to c.4200-3500 BP. Other sites such as Changkuang (Shi et al 2001: plate 41; Chao 2000) also have bowls with vertical handles/lugs, and date to the late second millennium B.C. This site also has fingernail impressed decoration on the inside of the vessel. In northeast Taiwan open mouthed vessels with handles/lugs are common at Yanliao site of Huangangshan Culture (Ye 2000:79-80).

There are also similarities between the Shimotabaru pottery form and a beaker from Fengpitou Phase 2 (Chang 1969: 94). The beakers are plain cylindrical flat base vessels, with two horizontal lugs below the rim (Chang

1969:94). This form is part of what Chang (1969: plate 57) calls "sandy red pottery" (Chang 1969 plate 57). Chang originally called this phase II of his Lungshanoid Culture and estimated its age to between 1900-1400 BC (Chang 1969:51, 228). The site is located on a terrace about 700 metres in from the present beach. The terrace is over 39 m above the road below, and Chang notes that this terrace would have had the sea lapping against it during occupation (Chang 1969:19). With the higher sea levels at that time, similar site locations are found in the Yaeyama Islands.

In short, there are a number of sites in Taiwan dating to the mid to late fifth millennium BP and early 4th millennium BP that have pot forms similar to those of the Shimotabaru phase. The similarities between Middle Neolithic Taiwan and assemblages in the Yaeyama Islands, however, slightly predated any movements from Taiwan south to the Philippines.

THE TAIWAN CONNECTION – ADZES

Similarities in adze forms have also been used to identify connections between the early Shimotabaru colonisers and areas to the west. Firstly, from the earlier excavations at Hateruma, adzes with a "rough transverse step on one side" were noted to at least have been an attempt at a "stepped butt" (Pearson 1969:85). Such stepping was thought to be closely associated with types found in Taiwan, southern China and the northern Philippines (Kanaseki et al 1964: 11). Although originally thought to be restricted to the Taipei Basin (Pearson 1969:111) they are now found wider afield, eg. Nanganli (Nan-kuan-Li), Tainan County (Tsang 2005:69) in TPK contexts. Secondly, Kokubu noted similar links between Yaeyama, Taiwan, and the Philippines based on the presence of trapezoidal sectioned adzes, called by Kokubu (1963:229) "semi-polished, ridged-stone implements". Lastly, Pearson (1969:105, 111) also noted similarities between the slightly polished, ovoid-in-section basaltic adzes from the T'ai Yuan and Peinan site and those sites from the Yaeyamas (Pearson 1969:105).

Any similarity between the adzes from these two areas was not the result of physical exchange. The adzes found in the Yaeyama Shimotabaru assemblages were from a variety of local rocks. From Pyutsuta the adzes were identified by a geologist (Itsuro Oshiro) as made from gabbro (Ishigaki City Education Board 1997: 85). However, from our observations these adzes were made from metamorphic greenschist. Adzes from Otabaru were not allocated a source rock in the original site report. However, from our own observations and from photographs in Takemoto and Asato (1993: plate 47) the earlier adzes appear again to have been made from greenschist. Greenschist adzes were also identified from Nakama No. 2 contexts (pers. observation). Outcrops of greenschist exist on Ishigaki next to the Otabaru site in the Tumuru Geological Formation (Foster 1965), and also on Iriomote. We were shown a beach level outcrop and adze-quarry site on the eastern coast of Iriomote at Nihara by Mr Takamine, a local resident. Adzes made from this material

are magnetite rich with lots of green amphiboles, and few crystals of black magnetite, and garnet is visible (Professor Alan Cooper, Otago University, pers. comm.). Although the latter outcrops would have been covered by water 4,500-4000 years ago, further outcrops are found inland on Iriomote. By its very nature, greenschist is difficult to polish, thus accounting for the partially polished nature of these adzes.

From Hateruma, a number of metamorphic rock types were used in the manufacture of adzes. Most were defined as gabbro, with dolerite (diabase), amphibolite and a single crystalline schist adze also found (Okinawa Prefectural Education Board 1986: 49-60). All these metamorphic rock types are found on Ishigaki. Also found from Hateruma were a series of round pecked hammer stones made from sandstone, granite, limestone, schist and gabbro. All these stones would have been imported into Hateruma. Granite outcrops are only found on Ishigaki within the Yaeyama group (Foster 1965:13).

We know the ages of the Shimotabaru adzes but what about the Taiwan adzes? Stone adzes first appear in Taiwan during the Dapenkeng (TPK) Culture in association with the first appearance of pottery at 5500 BP (Rolett et al. 2002 – see above). Quadrangular sectioned adzes occur after the TPK at about 4500 BP. The adzes are made from grey slate, green nephrite, andesite and basaltic rocks (Chang 1969). Some of the basaltic adzes found in Taiwan assemblages were quarried from Qimei Island, in the Penghu Archipelago (Rolett et al. 2002:313). Two sites with adzes from Penghu are Fengpitou, dated to between 4500 and 3500 BP (Chang 1969), and Nanganli (Bellwood and Hiscock 2005:284). Stylistically similar adzes to those made in Taiwan are also found on mainland China in 5000-4300 year old contexts at the Damaoshan site (Jiao 2007a, b), and also in 4000-3500 year old contexts in at the Huangguashan site (Rolett et al. 2002: 315, Tsang 2002:23), both in Fujian Province. The adzes from Damaoshan were not made locally, and could not be allocated to either the Penghu or mainland China sources (Guo et al. 2005). Those from Huangguashan were not quarried from the Penghu Archipelago (Rolett 2007: 58).

Hung (2004) has analysed over 1000 stone adzes from 210 Neolithic sites from Taiwan and the Penghu Archipelago and has identified source rocks for all these adzes (nephrite, andesite, basalt and slate). None are made from the same materials used in the manufacture of the Yaeyama adzes.

In conclusion, similar forms of adzes from the same period are shared between the Shimotabaru and Taiwan assemblages. Yet, there is no evidence of adzes from either location being traded between these two regions.

Nature of Interaction

Whatever the nature of interaction that occurred between Taiwan and Yaeyama, it is of a different nature to that which occurred between Taiwan and the Philippines in a number of respects. First, the majority of vessel forms and decorations shared between Taiwan and the Philippines

are absent. Only one vessel form was shared between Taiwan and the Shimotabaru assemblages.

Second, there is no jade (nephrite) in the Shimotabaru deposits. This is important as there is a strong association with movements south into Batanes and the Philippines and the presence of jade sourced to Taiwan (Iizuka et al. 2005, Iizuka and Hung 2005). Green jade was common from the middle Neolithic sites of Taiwan and nearby islands of Penghu. The main source is on the east coast of Taiwan. Sites with fine cord marked pottery in eastern Taiwan (Fushan and Beinan) and southern Taiwan produced a large number of jade bracelets. Hung (2005) notes the distribution of nephrite at the northern Luzon sites of Nagsabaran with red slipped pottery, and also Dimolit, Arku (Cagayan Valley) and other sites in Luzon. There is no natural source for jade in northern Luzon. She argues that “ancient Austronesians were very active in trading or exchanging jade from Early Neolithic times through into the Metal Age in the South China Sea region” (Hung 2005). Thus absence of jade in Yaeyama suggests a distribution network of jade which went to the south.

Third, spindle whorls that are common in northern Luzon and Taiwanese assemblages are absent in Shimotabaru contexts. Fourth, rice is absent in Yaeyama. Although the earliest evidence for rice and foxtail millet in Taiwan is from the site of Nanganli dated to 5,310-4,870 BP, there is no evidence for rice in the early Shimotabaru deposits. Indeed Takamiya (2006) suggests that agriculture is a late addition to the central Ryukyus, located further north. Pearson suggests that if early populations of Hateruma came from Taiwan, then they would have known cultivation (Pearson 1981: 141), and there are suggestions that historical Yaeyama agriculture was influenced from Taiwan. Yuji Ankei (referenced in Pearson 2003:95-96) reports that cultivation systems of Iriomote originated from the south; that traditional rice from Iriomote, *Oryza sativa javanica*, is different that from Okinawa and could have originated from Taiwan; and that the large yam grown on Iriomote also comes from Taiwan. The question is, when did these introductions first occur? Serious archaeological investigation into recovering palaeobotanical evidence is required.

Although the earlier occupation of the Yaeyama Island could account for some of the differences in the nature of interaction between Taiwan and the Philippines, it does not account for all. What makes the Yaeyama sites different is their brief chronology. Perhaps agriculture was not introduced, and in its absence there was no sustainable occupation on these small islands? The pottery and adzes found seem to be poor imitations to those found in Taiwan.

There are post-Shimotabaru connections to the west and south. Ohama (1996:27) argued that after the disappearance of the Shimotabaru ware there was a break of 800 years followed by an aceramic phase with *Tridacna* shell adzes suggesting ties with the Philippines (rather than communities to the north). The use of the hinge for the *Tridacna* shell adze suggests a connection with the

Philippines, but Ohama (1996:27) notes that that we need better sequences from the Philippines to confirm this.

Of interest is the presence of shell adzes found in Urasoko and other sites on Miyako Island (Takayama 2001). Shell adzes are also found round the Toguruhama site on Yonaguni (along with shark teeth with perforated holes, and operculum scrapers); and from Nagura Bay, Sakieda-Akasaki site, Saowaka-nishi shell mound, Fusaki shell mound, Hirakubo, Kandobaru and several other locations on Ishigaki. They are argued not to be found in the Shimotabaru period – they are post Shimotabaru. It is in the later period that shell adzes appear (from 2500 to 1000 years ago). However, it is important to note that one shell adze was found in association with Shimotabaru pottery at Nakama No.2 on Iriomote (Asato 1990:31). It was made from the hinge of the *Tridacna*. In fact, most of the shell adzes were made from the hinge, or using the hinge part. Shell adzes are not found in Okinawa nor in other northern Ryukyu Islands, nor in mainland Japan. They are also not found in contemporary levels in Taiwan. They are found in the Philippines and areas to the south, and also east in Micronesia. Those from the Philippines were made using the hinge part of the *Tridacna*, unlike in Micronesia, leading Asato (1990) to argue a case for cultural connections with this area.

CONCLUSIONS

The evidence presented suggests that the nature of Austronesian expansion out of Taiwan is complex. Occupation of the Yaeyama Islands some 4500-3900 years ago probably originated from Taiwan and probably by Austronesian-speaking populations (c.f. Hudson 2006), although the Yaeyama languages historically showed very little potential evidence of that. Whether these colonisers introduced agriculture is not known. Research into palaeobotanical remains is needed urgently on this matter. There is a degree of interaction between islands, with the transfer of pottery, faunal remains and adzes to Hateruma, and probably other islands as well. Evidence for this early occupation of Yaeyama is short lived, with sites disappearing after a few generations.

The pulse of colonisation and settlement by 4500-3900 cal BP in the Yaeyama region is consistent with post-TPK movement of ideas and peoples from Taiwan to the south, but the nature of the movement of people and ideas to the Yaeyama was different; less comprehensive in cultural content, much less expansive, and not just short-lived but quite possibly a colonisation which became extinct. Of course one important difference is that to the south of Taiwan, down to the end of the Solomon Island chain, there was a long previous history of human occupation. It was in these already occupied areas that agricultural expansion apparently took place.

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